Numerical approximation of a mathematical model of human phonation process with consideration of vocal fold periodical contacts

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Abstract

Voice production is a complex process, which involves airflow-driven self-oscillating vocal folds, which generate a source sound for excitation of the acoustic resonances in the vocal tract cavities. This paper is interested in the mathematical modelling of the voice production, where the vocal folds contact phenomena is addressed. A simplified problem is mathematically described with non-standard boundary conditions and the possible closure of the glottal part of the vocal tract is included in the model with the concept of a fictitious porous media. The Hertz impact force are used to model the vocal folds periodical contacts. The fluid motion is described by the incompressible Navier-Stokes equations coupled to the structural dynamics. The time dependent computational domain is treated with the aid of the Arbitrary Lagrangian-Eulerian method. The problem is discretized by a stabilized finite element method. Numerical results are shown.